

Appl. No. 09/932,304  
Response dated November 25, 2003  
Reply to Office action of July 25, 2003

**LISTING OF THE CLAIMS**

1. (Currently Amended) A model of a molecule, the molecule including a first element, a second element in spaced relation from the first element, and a force acting on the first element and the second element along a vector, the model comprising:

a first elongated strand extending along a first path corresponding to the first element;

a second elongated strand extending along a second path spaced from the first path and corresponding to the second element, at least one of the first elongated strand and the second elongated strand including a first segment and a second segment, the first segment and the second segment adapted to be interconnected in a single orientation; and

a connecting leg extending between the first elongated strand and the second elongated strand along a third path corresponding to the vector along which the force acts on the first element and the second element.

Claim 2 (Cancelled).

3. (Original) The model of claim 1 wherein the model is fabricated using a solid free form fabrication method.

4. (Original) The model of claim 3 wherein the solid free form fabrication method is a one of stereolithography, selective laser sintering, fused deposition modeling, and laminated object manufacturing.

5. (Original) The model of claim 1 wherein the molecule includes a plurality of elements and wherein the first elongated strand corresponds to a first subset of the plurality of elements, wherein the second elongated strand corresponds to a second subset of the plurality of elements, and wherein a force acts on at least two of the plurality of elements.

6. (Original) The model of claim 5 wherein the plurality of elements is a plurality of alpha carbons and wherein the force acting on the at least two of the plurality of elements is a hydrogen bond between at least two of the plurality of alpha carbons.

7. (Original) The model of claim 6 wherein the molecule includes a side chain and wherein the model includes a branch representing the side chain and coupled to at least one of the first elongated strand and the second elongated strand.

8. (Original) The model of claim 7 wherein the molecule includes a substrate and wherein the model includes a spherical member representing the substrate and coupled to at least one of the first elongated strand and the second elongated strand.

9. (Original) The model of claim 8 wherein at least one of the first elongated strand, the second elongated strand, the connecting leg, the branch, and the spherical member are color-coded according to an atomic color scheme.

10. (Original) The model of claim 9 wherein the atomic color scheme is the Corey, Pauling, Kultin color scheme.

11. (Original) The model of claim 9 wherein the atomic color scheme includes at least one of gray representing carbon, white representing hydrogen, red representing oxygen, blue representing nitrogen, orange representing iron or phosphorus, and yellow representing sulfur.

12. (Currently Amended) The model of claim 1 wherein the model includes at least two segments and wherein the at least two segments first segment and the second segment have respective ends having engagement surfaces affording interconnection of the at least two segments first segment and the second segment.

Appl. No. 09/932,304  
Response dated November 25, 2003  
Reply to Office action of July 25, 2003

13. (Currently Amended) The model of claim 12 wherein one of the ~~at least two segments~~ first segment and the second segment includes a male slide connector engagement surface and the other of the ~~at least two segments~~ first segment and the second segment includes a female slide connector engagement surface.

Claim 14 (Cancelled).

15. (Currently Amended) The model of claim 12 wherein the engagement surfaces are joined with a deformable piece of material, allowing the ~~segments~~ first segment and the second segment to move with respect to one another, while preventing the ~~segments~~ first segment and the second segment from completely separating from one another.

16. (Original) The model of claim 1 wherein the molecule is a protein.

17. (Original) The model of claim 16 wherein the protein is a one of adenosine tri-phosphate-ase, beta-globin, calmodulin, chymotrypsin, green fluorescent protein, human immunodeficiency virus protease, lysozyme, myosin, p53, zif268, zinc finger, major histocompatibility complex, immunoglobulin, lac repressor, and beta-galactosidase.

Appl. No. 09/932,304  
Response dated November 25, 2003  
Reply to Office action of July 25, 2003

18. (Currently Amended) A model of a molecule, the molecule including a plurality of alpha carbons and a plurality of bonds delineating a first three-dimensional path, the model comprising:

a first elongated tubular strand representing the plurality of alpha carbons and the plurality of bonds and extending along the first three-dimensional path, the first elongated tubular strand including at least two first strand segments, the at least two first strand segments adapted to be interconnected in a single orientation.

19. (Original) The model of claim 18 wherein the molecule includes a plurality of alpha carbons and a plurality of bonds delineating a second three-dimensional path, and wherein the model further comprises a second elongated tubular strand representing the plurality of alpha carbons and the plurality of bonds and extending in spaced relation to the first elongated tubular strand along the second three-dimensional path.

20. (Original) The model of claim 19 wherein the molecule includes a hydrogen bond, and wherein a connecting leg representing the hydrogen bond is coupled between the first elongated tubular strand and the second elongated tubular strand.

Claim 21 (Cancelled).

22. (Original) The model of claim 20 wherein the molecule includes a side chain and wherein the model includes a branch representing the side chain and coupled to at least one of the first elongated strand and the second elongated strand.

23. (Original) The model of claim 22 wherein the molecule includes a substrate and wherein the model includes a spherical member representing the substrate and coupled to at least one of the first elongated strand and the second elongated strand.

24. (Original) The model of claim 23 wherein at least one of the first elongated strand, the second elongated strand, the connecting leg, the branch, and the spherical member are color-coded according to an atomic color scheme.

25. (Original) The model of claim 24 wherein the atomic color scheme is the Corey, Pauling, Kultin color scheme.

26. (Original) The model of claim 24 wherein the atomic color scheme includes at least one of gray representing carbon, white representing hydrogen, red representing oxygen, blue representing nitrogen, orange representing iron or phosphorus, and yellow representing sulfur.

27. (Currently Amended) The model of claim 19 wherein ~~the first elongated tubular strand includes at least two first strand segments, each of the at least two first strand segments having have~~ an end providing an engagement surface adapted to mate with an engagement surface of ~~the other another~~ of the at least two first strand segments.

28. (Currently Amended) The model of claim 27 wherein the second elongated tubular strand includes at least two second strand segments, each of the at least two second strand segments having an end providing an engagement surface adapted to mate with an engagement surface of ~~the other another~~ of the at least two second strand segments.

29. (Currently Amended) The model of claim 28 wherein one of the at least two first strand segments and one of the at least two second strand segments includes a male slide connector engagement surface and ~~the other another~~ of the at least two first strand segments and the at least two second strand segments includes a female slide connector engagement surface.

Claim 30 (Cancelled).

31. (Original) The model of claim 28 wherein the engagement surfaces are joined with a deformable piece of material, allowing the at least two first strand segments and the at least two second strand segments to move with respect to one another, while preventing the at least two first strand segments and the at least two second strand segments from completely separating from one another.

Appl. No. 09/932,304  
Response dated November 25, 2003  
Reply to Office action of July 25, 2003

32. (Original) The model of claim 18 wherein the model is fabricated using a solid free form fabrication method.

33. (Original) The model of claim 32 wherein the solid free form fabrication method is one of stereolithography, selective laser sintering, fused deposition modeling, and laminated object manufacturing.

34. (Original) The model of claim 18 wherein the molecule is a protein.

35. (Original) The model of claim 34 wherein the protein is one of adenosine tri-phosphate-ase, beta-globin, calmodulin, chymotrypsin, green fluorescent protein, human immunodeficiency virus protease, lysozyme, myosin, p53, zif268, zinc finger, major histocompatibility complex, immunoglobulin, lac repressor, and beta-galactosidase.

Appl. No. 09/932,304  
Response dated November 25, 2003  
Reply to Office action of July 25, 2003

36. (Currently Amended) A model of a molecule, the molecule having a first set of alpha carbons, a second set of alpha carbons, and a hydrogen bond acting on one alpha carbon of the first set of alpha carbons and one alpha carbon of the second set of alpha carbons, the model comprising:

a first elongated strand extending along a first path corresponding to the first set of alpha carbons;

a second elongated strand extending along a second path corresponding to the second set of alpha carbons, at least one of the first elongated strand and the second elongated strand including a first segment and a second segment, the first segment and the second segment adapted to be interconnected in a single orientation; and

a connecting leg extending between the first elongated strand and the second elongated strand along a path corresponding to the hydrogen bond.

Claim 37 (Cancelled).

38. (Original) The model of claim 36 wherein the model is fabricated using a solid free form fabrication method.

39. (Original) The model of claim 38 wherein the solid free form fabrication method is a one of stereolithography, selective laser sintering, fused deposition modeling, and laminated object manufacturing.

40. (Original) The model of claim 36 wherein the molecule includes a side chain and wherein the model includes a branch representing the side chain and coupled to at least one of the first elongated strand and the second elongated strand.

41. (Original) The model of claim 40 wherein the molecule includes a substrate and wherein the model includes a spherical member representing the substrate and coupled to at least one of the first elongated strand and the second elongated strand.

Appl. No. 09/932,304  
Response dated November 25, 2003  
Reply to Office action of July 25, 2003

42. (Original) The model of claim 41 wherein at least one of the first elongated strand, the second elongated strand, the connecting leg, the branch, and the spherical member are color-coded according to an atomic color scheme.

43. (Original) The model of claim 42 wherein the atomic color scheme is the Corey, Pauling, Kultin color scheme.

44. (Original) The model of claim 42 wherein the atomic color scheme includes at least one of gray representing carbon, white representing hydrogen, red representing oxygen, blue representing nitrogen, orange representing iron or phosphorus, and yellow representing sulfur.

45. (Currently Amended) The model of claim 36 wherein the ~~model includes at least two segments and wherein the at least two segments~~ first segment and the second segment each have respective ends having engagement surfaces affording interconnection of the ~~at least two segments~~ first segment and the second segment.

46. (Currently Amended) The model of claim 45 wherein one of the ~~at least two segments~~ first segment and the second segment includes a male slide connector engagement surface and the other of the ~~at least two segments~~ first segment and the second segment includes a female slide connector engagement surface.

Claim 47 (Cancelled).

48. (Currently Amended) The model of claim 45 wherein the engagement surfaces are joined with a deformable piece of material, allowing the ~~at least two segments~~ first segment and the second segment to move with respect to one another, while preventing the ~~at least two segments~~ first segment and the second segment from completely separating from one another.

49. (Original) The model of claim 36 wherein the molecule is a protein.

Appl. No. 09/932,304  
Response dated November 25, 2003  
Reply to Office action of July 25, 2003

50. (Original) The model of claim 49 wherein the protein is one of adenosine tri-phosphate-ase, beta-globin, calmodulin, chymotrypsin, green fluorescent protein, human immunodeficiency virus protease, lysozyme, myosin, p53, zif268, zinc finger, major histocompatibility complex, immunoglobulin, lac repressor, and beta-galactosidase.

51. (Currently Amended) A ~~macro-molecule~~ protein construction kit, the kit comprising:

a plurality of amino acid backbone units adapted to be removably coupled to one another in one of two orientations, each one of the plurality of amino acid backbone units representing an assembly of atoms;

a plurality of hydrogen bond units coupleable removably coupled to each one of the plurality of amino acid backbone units; and

a plurality of side chain units coupleable removably coupled to each one of the plurality of amino acid backbone units.

52. (Original) The kit of claim 51 wherein each one of the plurality of amino acid backbone units includes a plurality of spherical members representing each atom of the assembly of atoms and a plurality of tubular members representing bonds between each atom of the assembly of atoms.

53. (Original) The kit of claim 52 wherein the plurality of spherical members includes a first spherical member representing a nitrogen atom, a second spherical member representing an alpha carbon atom, a third spherical member representing a carbonyl carbon atom, and a fourth spherical member representing an oxygen atom.

Claim 54 (Cancelled).

55. (Currently Amended) The kit of claim 54 106 wherein the first shape is a spherical shape representing a hydrogen bond and the second shape is a double spherical shape representing a covalent peptide bond, the double spherical shape adapted to allow insertion into the female engagement surface in one of two orientations.

56. (Currently Amended) The kit of claim 54 106 wherein the second spherical member representing the alpha carbon atom includes a female engagement surface having a third shape coupleable to each one of the plurality of side chains.

57. (Original) The kit of claim 56 wherein the third shape is a spherical shape representing a covalent bond.

58. (Original) The kit of claim 56 wherein the third spherical member representing the carbonyl carbon atom includes a male engagement surface having the second shape and coupleable to the first spherical member representing the nitrogen atom of each one of the plurality of amino acid backbone units.

59. (Original) The kit of claim 58 wherein the fourth spherical member representing the oxygen atom includes a female engagement surface having the first shape coupleable to each one of the plurality of hydrogen bond units.

60. (Original) The kit of claim 59 wherein each one of the plurality of the hydrogen bond units includes a spherical member coupled between a first male engagement surface having the first shape and a second male engagement surface having the first shape, the first male engagement surface and the second male engagement surface lying within a straight line.

61. (Original) The kit of claim 60 wherein each one of the plurality of side chain units includes at least one spherical member and at least one male engagement surface having the third shape coupleable to the female engagement surface having the third shape of the second spherical member representing the alpha carbon atom of each one of the plurality of amino acid units.

62. (Original) The kit of claim 53 wherein each one of the plurality of amino acid units includes a first plane within which the first spherical member, the second spherical member, and the third spherical member lie, and a second plane in which the second spherical member, the third spherical member, and the fourth spherical member lie.

63. (Original) The kit of claim 62 wherein the first plane is rotated with respect to the second plane about a tubular member representing a bond between the alpha carbon atom and the carbonyl carbon atom.

64. (Original) The kit of claim 53 wherein each one of the plurality of amino acid units includes a phi angle of rotation about a tubular member representing a bond between the nitrogen atom and the alpha carbon atom, and a psi angle of rotation about a tubular member representing a bond between the alpha carbon atom and the carbonyl carbon.

65. (Currently Amended) The kit of claim 64 wherein the kit is an alpha helix construction kit, and wherein the phi angle is approximately negative 57 degrees and the psi angle is approximately negative 47 degrees.

66. (Currently Amended) The kit of claim 65 wherein the alpha helix construction kit includes approximately 47 individual units, wherein the plurality of amino acid units includes approximately 12 of the 47 individual units, wherein the plurality of hydrogen bond units includes approximately 15 of the 47 individual units, and wherein the plurality of side chain units includes approximately 20 of the 47 individual units, so that when the alpha helix construction kit is assembled, the alpha helix construction kit represents one and a half turns of a right-handed alpha helix.

67. (Currently Amended) The kit of claim 64 wherein the kit is a beta sheet construction kit, and wherein the plurality of amino acid backbone units includes a plurality of parallel backbone units, each one of the plurality of parallel backbone units having a phi angle of approximately negative 119 degrees and a psi angle of approximately positive 113 degrees, and wherein the plurality of amino acid backbone units includes a plurality of anti-parallel backbone units, each one of the plurality of anti-parallel backbone units having a phi angle of approximately negative 139 degrees and a psi angle of approximately positive 135 degrees.

68. (Currently Amended) The kit of claim 67 wherein the beta sheet construction kit includes approximately 104 individual units, wherein the plurality of parallel backbone units includes approximately 28 of the 104 individual units, wherein the plurality of anti-parallel backbone units includes approximately 28 of the 104 individual units, wherein the plurality of hydrogen bond units includes approximately 20 of the 104 individual units, and wherein the plurality of side chain units includes approximately 28 of the 104 individual units.

69. (Original) The kit of claim 51 wherein the plurality of side chain units represents at least two of glycine, alanine, valine, leucine, isoleucine, serine, threonine, cysteine, methionine, proline, aspartic acid, asparagine, glutamic acid, glutamine, lysine, arginine, histidine, phenylalanine, tyrosine, and tryptophan.

70. (Original) The kit of claim 51 wherein at least one of the plurality of amino acid backbone units, the plurality of hydrogen bond units, and the plurality of side chain units is color-coded according to an atomic color scheme.

71. (Original) The model of claim 70 wherein the atomic color scheme is the Corey, Pauling, Kultin color scheme.

72. (Original) The model of claim 70 wherein the atomic color scheme includes at least one of gray representing carbon, white representing hydrogen, red representing oxygen, blue representing nitrogen, orange representing iron or phosphorus, and yellow representing sulfur.

Appl. No. 09/932,304  
Response dated November 25, 2003  
Reply to Office action of July 25, 2003

Claims 73 – 102 (Cancelled).

103. (Re-presented – formerly dependent claim # 14) A model of a molecule, the molecule including a first element, a second element in spaced relation from the first element, and a force acting on the first element and the second element along a vector, the model comprising:

a first elongated strand extending along a first path corresponding to the first element;

a second elongated strand extending along a second path spaced from the first path and corresponding to the second element, at least one of the first elongated strand and the second elongated strand including at least two segments, the at least two segments having respective ends having engagement surfaces affording interconnection of the at least two segments, one of the at least two segments including a male slide connector engagement surface and the other of the at least two segments including a female slide connector engagement surface, the male slide connector engagement surface and the female slide connector engagement surface adapted to be interconnected in a single orientation; and

a connecting leg extending between the first elongated strand and the second elongated strand along a third path corresponding to the vector along which the force acts on the first element and the second element.

104. (Re-presented – formerly dependent claim # 30) A model of a molecule, the molecule including a first plurality of alpha carbons and a first plurality of bonds delineating a first three-dimensional path and a second plurality of alpha carbons and a second plurality of bonds delineating a second three-dimensional path, the model comprising:

a first elongated tubular strand representing the first plurality of alpha carbons and the first plurality of bonds and extending along the first three-dimensional path, the first elongated tubular strand including at least two first strand segments, each of the at least two first strand segments having an end providing an engagement surface adapted to mate with an engagement surface of the other of the at least two first strand segments; and

a second elongated tubular strand representing the second plurality of alpha carbons and the second plurality of bonds and extending in spaced relation to the first elongated tubular strand along the second three-dimensional path, the second elongated tubular strand including at least two second strand segments, each of the at least two second strand segments having an end providing an engagement surface adapted to mate with an engagement surface of the other of the at least two second strand segments;

one of the at least two first strand segments and one of the at least two second strand segments including a male slide connector engagement surface and another of the at least two first strand segments and the at least two second strand segments including a female slide connector engagement surface, the male slide connector engagement surface and the female slide connector engagement surface being adapted to be interconnected in a single orientation.

105. (Re-presented – formerly dependent claim # 47) A model of a molecule, the molecule having a first set of alpha carbons, a second set of alpha carbons, and a hydrogen bond acting on one alpha carbon of the first set of alpha carbons and one alpha carbon of the second set of alpha carbons, the model comprising:

a first elongated strand extending along a first path corresponding to the first set of alpha carbons;

a second elongated strand extending along a second path corresponding to the second set of alpha carbons; and

a connecting leg extending between the first elongated strand and the second elongated strand along a path corresponding to the hydrogen bond;

the model including at least two segments, the at least two segments having respective ends having engagement surfaces affording interconnection of the at least two segments, one of the at least two segments including a male slide connector engagement surface and the other of the at least two segments including a female slide connector engagement surface, the male slide connector engagement surface and the female slide connector engagement surface being adapted to be interconnected in a single orientation.

Appl. No. 09/932,304  
Response dated November 25, 2003  
Reply to Office action of July 25, 2003

106. (Re-presented – formerly dependent claim # 54) A macro-molecule construction kit, the kit comprising:

a plurality of amino acid backbone units, each one of the plurality of amino acid backbone units representing an assembly of atoms, each one of the plurality of amino acid backbone units including a plurality of spherical members representing each atom of the assembly of atoms and a plurality of tubular members representing bonds between each atom of the assembly of atoms, the plurality of spherical members including a first spherical member representing a nitrogen atom, a second spherical member representing an alpha carbon atom, a third spherical member representing a carbonyl carbon atom, and a fourth spherical member representing an oxygen atom;

a plurality of hydrogen bond units coupleable to each one of the plurality of amino acid backbone units, the first spherical member of each amino acid backbone unit representing the nitrogen atom including a first female engagement surface having a first shape coupleable to each one of the plurality of hydrogen bond units, and a second female engagement surface having a second shape coupleable to the third spherical member representing the carbonyl carbon atom of each one of the plurality of amino acid backbone units; and

a plurality of side chain units coupleable to each one of the plurality of amino acid backbone units.